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Annotated Bibliography of Nematodes of Soybeans

1969-73

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Annotated Bibliography of Nematodes of Soybeans

1969-73

D. I. Edwards and J. M. Epps [1]

Soybeans rank among the leading crops in the United States and additional production will be needed to meet the ever increasing domestic and foreign demands. Plant parasitic nematodes limit production of this important crop. The soybean cyst nematode alone may reduce yield as much as 50 million bushels per year in the United States. Besides the soybean cyst nematode, other nematode species, about which little is known, are capable of reducing yields. A continuing effort must be made to study the biology, host-parasite relations, pathogenicity, and control of nematodes affecting soybeans.

In 1973, an annotated bibliography of nematodes of soybeans[2] was published for the first time. This bibliography, which contains 380 references published from 1882 through 1968, brings together a list of references on soybean nematodes so that interested readers might readily become familiar with nematode problems of this crop.

This continuation of the original bibliography covers titles published primarily from 1969 through 1973. However, some articles published before 1969 and overlooked in the original bibliography appear in this publication. A publication of this nature cannot possibly be complete and some references related to this subject may have been omitted. We shall greatly appreciate the readers bringing such omissions to our attention so they can be incorporated in our revisions.

The appendix lists the scientific names of the genera and some species and the numerical reference to literature contained in this bibliography.

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[1] Nematologists, Agricultural Research Service, U.S. Department of Agriculture: D. I. Edwards, North Central Region, 107F Horticulture Field Lab, Univ. of Ill., Urbana, Ill. 61801; and J. M. Epps, Southern Region, West Tenn. Exp. Sta., Jackson, Tenn. 38301.

[2] Epps, J. M., Edwards, D. I., Good, J. M., and Rebois, R. V. Annotated Bibliography of Nematodes of Soybeans, 1882-1968. U.S. Dept. Agr., Agr. Res. Ser. ARS-S-8, 75 pp. January 1973.

1. Anonymous. 1957. THE SOYBEAN CYST NEMATODE. U.S. Dept. Agr., PA-333, 4 pp.

This general publication on the soybean cyst nematode, *Heterodera glycines*, discusses type of damage, the nematode's life cycle, spread, detection, and control measures.

2. ______ 1970. SOYBEAN INVESTIGATIONS. Miss. Agr. Forest. Exp. Sta. 83d Annual Report, Fiscal Year Ending June 30, 1970:74.

Mention is made of soybean varieties that are resistant to root-knot and soybean cyst nematodes. This resistance in combined with tolerance to fungal diseases.

3. ______ 1970. REPORT ON THE BREEDING OF THE NEW SOYBEAN VARIETIES RAIDEN AND RAIKO BY MEANS OF IRRADIATION. Bul. Tohoku Agr. Exp. Sta. 40: 65-105. (In Japanese.)

This report on soybean varieties, Raiden and Raiko, discusses their breeding by means of irradiation. The varieties are tolerant to *Heterodera glycines*.

4. Agrios, G. N. 1969. PLANT PATHOLOGY. Ch. 13. Academic Press, New York and London.

The morphology, life cycle, disease symptoms, and control measures of *Heterodera glycines* are discussed.

5. Aist, S. and R. D. Riggs. 1969. AMINO ACIDS FROM "HETERODERA GLYCINES". J. Nematol. 1(3): 254-259.

The amino acids emitted and extracted from adults and larvae of *Heterodera glycines* were investigated. The amount of Proline was the greatest after infection of soybeans.

6. Balasubramanian, M. 1971. ROOT-KNOT NEMATODES AND BACTERIAL NODULATION IN SOYBEAN. Cur. Sci. 40(3): 69-70.

Nodulation by *Rhizobium japonicum* was less in the presence of *Meloidogyne javanica*, *M. hapla* and *M. incognita*, with *M. javanica* showing the greatest reduction.

7. Baldwin, C. H. and L. A. Duclos. 1973. SOYBEAN CYST NEMATICIDE RESEARCH FOR MISSOURI, 1972. Univ. of Mo., Dept. of Plant Path. Misc. Pub. No. 2, 15 pp.

Twenty-eight chemicals were evaluated for control of the soybean cyst nematode, *Heterodera glycines*, in southeast Missouri. The authors concluded that nematicides have a definite place in controlling the cyst nematode. Crop rotation and use of resistant varieties still can play a role in control programs.

8. Barker, K. R. and D. Huisingh. 1969. EFFECTS OF NITROGEN AND "RHIZOBIUM JAPONICUM" ON THE DEVELOPMENT OF "HETERODERA GLYCINES" ON SOYBEAN. (Abstract) Phytopathology 59(2): 111.

Soybean plants, infected with *H. glycines* and treated with *R. japonicum* and nitrogen, showed a decrease in the number of cysts.

9. ______ and D. Huisingh. 1970. HISTOLOGICAL INVESTIGATIONS OF THE ANTAGONISTIC INTERACTION BETWEEN "HETERODERA GLYCINES" AND "RHIZOBIUM JAPONICUM" ON SOYBEAN. (Abstract) Phytopathology 60(9): 1282-1283.

Nodule development was inhibited when soybean plants were simultaneously inoculated with *H. glycines* and *R. japonicum*. Histological studies of nodular and adjacent tissues showed unfavorable development for nematode and syncytia.

10. ______ P. S. Lehman, and D. Huisingh. 1971. INFLUENCE OF NITROGEN AND "RHIZOBIUM JAPONICUM" ON THE ACTIVITY OF "HETERODERA GLYCINES". Nematologica 17(3): 377-385.

Nitrogen and *R. japonicum* had an inhibitory effect on hatch, penetration and cyst development of *H. glycines*. Inhibitory effects were correlated to the concentration of N.

11. Birchfield, W. and L. R. Brister. 1969. REACTION OF SOYBEAN VARIETIES TO THE RENIFORM NEMATODE, "ROTYLENCHULUS RENIFORMIS". Plant Dis. Rptr. 53(12): 999-1000.

Nineteen soybean varieties were found resistant to *R. reniformis*, with Pickett and Dyer being highly resistant and Hardee, Coker 318, Bragg, Lee 68, Davis, and Dare moderately resistant; other varieties were considered susceptible.

12. ______ and J. F. Parr. 1969. NEMATICIDAL AND FUNGICIDAL EFFECTS OF SOME SOIL-APPLIED NITROGEN COMPOUNDS. (Abstract) Phytopathology 59 (8): 1018.

Solutions of potassium azide in liquid anhydrous ammonia showed better control of *Rotylenchulus reniformis* on soybeans than liquid anhydrous ammonia alone, which gave higher yields of soybean forage.

13. ______ J. F. Parr, and S. Smith. 1969. NEMATICIDAL AND FUNGICIDAL ACTIVITY OF POTASSIUM AZIDE IN LIQUID ANHYDROUS AMMONIA. Plant Dis. Rptr. 53(12): 923-926.

See citation No. 12.

14. ______ C. Williams, E. E. Hartwig, and L. R. Brister. 1971. RENIFORM NEMATODE RESISTANCE IN SOYBEANS. Plant Dis. Rptr. 55(12): 1043-1045.

Resistance to the reniform nematode, *Rotylenchulus reniformis,* was classified into three groups. Twenty cultivars are mentioned in these groups. Resistance to the soybean cyst nematode does not infer resistance to the reniform nematode. Separate but linked genes may give resistance to both nematodes.

15. BIRD, G. W., J. L. CRAWFORD, and N. E. MCGLOHON. 1973. DISTRIBUTION, FREQUENCY OF OCCURRENCE AND POPULATION DYNAMICS OF "ROTYLENCHULUS RENIFORMIS" IN GEORGIA. Plant Dis. Rptr. 57 (5): 399-401

The reniform nematode has been observed on soybean since 1969 in Georgia. Currently it is present in 12 different locations where either cotton and peanuts or cotton and soybeans are rotated. Investigations of population dynamics of *R. reniformis* on cotton and soybeans showed no apparent differences.

16. BURNS, N. C. 1971. SOIL PH EFFECTS ON NEMATODE POPULATIONS ASSOCIATED WITH SOYBEANS. J. Nematol. 3(3): 238-245.

Amsoy soybeans showed the greatest numbers of *Pratylenchus alleni* colonizing in soil at pH 6.0; also *Hoplolaimus galeatus* and members of Tylenchinae-Psilenchinae survived well at this pH. Dorylaimoidea populations were higher at pH 6.0 and pH 8.0. At pH 8.0 non-stylet nematodes were recovered in greater numbers. At pH 4.0, where fewer nematodes were found, potassium, manganese, and phenols were highest in the plants.

17. ______ and D. C. NORTON. 1970. INFLUENCE OF SOIL PH ON NEMATODE POPULATIONS ASSOCIATED WITH SOYBEANS. (Abstract) J. Parasitol. 56(4): 43.

See citation No. 16.

18. COLLINS, R. J. and R. RODRIGUES-KABANA. 1971. RELATIONSHIP OF FERTILIZER TREATMENTS AND CROP SEQUENCE TO POPULATIONS OF LESION NEMATODES. (Abstract) J. Nematol. 3(4): 306-307.

Soil and root populations of *Pratylenchus scribneri* from soybean plots were influenced by cropping sequences and the omission or inclusion of N, P, K, and lime. Addition of minor elements did not affect nematode populations.

19. CRITTENDEN, H. W. 1966. DISEASE RATING OF TWELVE SOYBEAN VARIETIES IN DELAWARE. Univ. of Del. Agr. Ext. Ser., Ext. Cir. 127, 4 pp.

The following varieties are listed in order of their decreasing resistance to root-knot nematode: Delmar, Bethel, Hill, Dare, Ogden, Lee, Hood, Clark '63, Kent, Wayne, Shelby, and Adelphia.

20. DONALDSON, Jr., F. 1964. THE CYST NEMATODES IN FLORIDA. Nematology Cir. 3. Fla. Dept. Agr. 3 pp.

Although not presently found in Florida, the soybean cyst nematode, *Heterodera glycines*, is recognized as a serious pest and a constant lookout is being made.

21. DROPKIN, V. H. and P. E. NELSON. 1961. THE PATHOGENICITY OF "MELOIDOGYNE" SPP. (ROOT-KNOT NEMATODES), PARTICULARLY ON SOYBEANS. *In* Recent Advances in Botany, 1: 410-414. 9th Internatl. Bot. Congr., Montreal, 1959.

Studies on the pathogenicity of *Meloidogyne incognita incognita* and *M. incognita acrita* on soybeans showed the following effects: hypertrophy and hyperplasia of parenchyma cells and pericycle tissues, hypertrophy of cortex in young roots, failure of vascular cambium in portions of the stele invaded by larvae, abnormal meristems, cell necrosis, and differentiation of tracheids and vessel elements outside the secondary xylem. Also giant cells were classified into four types.

22. DUCLOS, L. A. and J. M. EPPS. 1969. BREEDING SOYBEANS FOR RESISTANCE TO THE SOYBEAN CYST NEMATODE ("HETERODERA GLYCINES"). (Abstract) Agron. Abs. Madison 1969: 5.

One dominant and three recessive genes may determine the resistance of three soybean varieties to *H. glycines*.

23. EDWARDS, D. I. 1967. SOYBEAN NEMATODE PROBLEMS AND RESEARCH IN ILLINOIS. 2d Soybean Prod. Conf., Urbana, Ill., 1967: 34-36.

A general discussion of the soybean cyst nematode, *Heterodera glycines*, covers distribution, symptomatology, and control. Other nematode species capable of parasitizing soybean in Illinois include *Pratylenchus alleni* and *Ditylenchus dipsaci*. Five genera were found to be common and widely distributed. These were *Tylenchus, Helicotylenchus, Paratylenchus, Tylenchorhynchus,* and *Xiphinema.*

24. ______ 1969. NEMATODES—A FACTOR LIMITING SOYBEAN PRODUCTION. Soybean News 21: 3, 5, and 6.

A general discussion of nematodes affecting soybeans is presented. Modes of parasitism, symptomatology, and control measures are discussed. *Heterodera glycines, Meloidogyne* spp. and *Pratylenchus* spp. are listed as specific examples.

25. ______ 1969. THE SOYBEAN CYST NEMATODE. 21st Ill. Custom Spray Operators Training School, Urbana, Ill., 1969: 48-49.

A general discussion is presented of the soybean cyst nematode, *Heterodera glycines*, covering distribution, losses, symptomatology and races. Control is discussed in terms of crop rotation, resistant varieties, and nematicides.

26. ______ 1973. NEMATODE PROBLEMS ASSOCIATED WITH SOYBEAN PRODUCTION. Rpt. Second Natl. Soybean Res. Conf., Memphis, Tenn., March 5-8, 1973. U.S. Reg. Soybean Lab., Urbana, Ill. RSLM 775: 24-26.

This report discusses nematode problems on soybeans in the United States. Genera mentioned include *Heterodera, Meloidogyne, Pratylenchus, Belonolaimus, Rotylenchulus, Hoplolaimus, Helicotylenchus, Paratylenchus, Tylenchorhynchus, Xiphinema, Ditylenchus, Trichodorus*, and *Criconemoides*.

27. ______ 1973. SOYBEAN CYST NEMATODE-WHERE ARE WE NOW? 25th Ill. Custom Spray Operators Training School, Urbana, Ill. 1973: 106-108.

The soybean cyst nematode, *Heterodera glycines*, is discussed in terms of distribution, crop loss, and field symptoms. The use of resistant varieties, quarantines, crop rotations, and chemicals as control measures are discussed in view of Races 3 and 4 of this nematode.

28. ______ and A. M. GOLDEN. 1971. THE OCCURRENCE OF THE LESPEDEZA CYST NEMATODE IN ILLINOIS. Plant Dis. Rptr. 55(2): 114.

Cysts collected from a soybean field in Hamilton County, Ill., were thought to be those of the soybean cyst nematode. A greenhouse test showed reproduction on Kobe lespedeza but not on soybean. The nematode was identified as *Heterodera lespedezae*, the first report for the State.

29. ______ and R. B. MALEK. 1971. CYST PRODUCTION BY "HETERODERA LESPEDEZAE" ON SELECTED LEGUMES. Plant Dis. Rptr. 55(10): 927-929.

Eighteen species of legumes were tested as to host suitability for the Illinois population of *H. lespedezae*. Soybean lines Clark-63, Custer, and NC-55 proved to be nonhosts.

30. ______ and R. B. MALEK. 1971. NON-REPRODUCTION OF "HETERODERA LESPEDEZAE" ON "HETERODERA GLYCINES" RACE DIFFERENTIATING SOYBEAN LINES. Plant Dis. Rptr. 55(11): 974-975.

H. lespedezae did not reproduce on any of the soybean lines and varieties used to differentiate races of the soybean cyst nematode.

31. ______ R. B. MALEK, and M. C. SHURTLEFF. 1972. THE SOYBEAN CYST NEMATODE PROBLEM. Co-op. Ext. Serv. Rpt. on Plant Dis., Univ. of Ill. 501, 6 pp.

This is a report on the importance, symptomatology, distribution, life history, host plants, means of spread, and control of the soybean cyst nematode, *Heterodera glycines*.

32. ______ and R. A. SIKORA. 1970. AN EVALUATION OF NEMATICIDES FOR CONTROL OF THE SOYBEAN CYST NEMATODE. (Abstract) VII Internatl. Cong. of Plant Protect., Paris, Sept. 21-25, pp. 196-197.

Mocap applied at 706 kg/ha and Rotox applied at 1,500 kg/ha did not increase soybean yields above those obtained with the resistant variety, Custer. Rotox significantly increased the yield of the susceptible variety over the untreated control, while no significant increase was realized with Mocap.

33. ELMILIGY, I. A. 1968. THE OCCURRENCE OF "HETERODERA GLYCINES" ON "TRIFOLIUM ALEXANDRINUM" IN THE UNITED ARAB REPUBLIC. Nematologica 14(4): 592-593.

H. glycines has been reported for the first time from the United Arab Republic infecting *T. alexandrinum*.

34. ______ 1970. ON SOME HOPLOLAIMINAE FROM CONGO AND EGYPT. Meded. Rijksfac. Landbwet. Gent 35(4): 1141-1153.

Helicotylenchus dihystera was found in soil around the roots of *Glycine* spp.

35. ENDO, B. Y. 1970. NUCLEIC ACID SYNTHESIS AT SOYBEAN INFECTION SITES INVADED BY THE SOYBEAN CYST NEMATODE. (Abstract) Phytopathology 60(6): 1014.

When infective larvae penetrated resistant and susceptible soybeans, synthesis and localization of nucleic acids took place at infection sites. Infective larvae near the vascular tissues stimulated the cells near the lip region, resulting in increased nuclear size and DNA synthesis. After syncytial formation, nuclei became quiescent while DNA synthesis took place in newly incorporated cells, surrounding tissues, and in regions of normal tissue differentiation. RNA synthesis remained active and detectable during infection periods.

36. ______ 1971. SYNTHESIS OF NUCLEIC ACIDS AT INFECTION SITES OF SOYBEAN ROOTS PARASITIZED BY "HETERODERA GLYCINES". Phytopathology 61(4): 395-399.

Syncytial nuclei are enlarged and relatively inactive in terms of DNA synthesis in soybean roots infected with the soybean cyst nematode. However, the leading edges of syncytia showed high ^{3}H-methyl-thymadine uptake, signifying that these were sites of active DNA synthesis.

37. ______ and J. A. Veech. 1969. COMPARATIVE ENZYME HISTOCHEMISTRY IN ROOT-KNOT RESISTANT AND SUSCEPTIBLE SOYBEANS. (Abstract) J. Nematol. 1(4): 285-286.

A comparative study of enzyme activity in a resistant variety of soybeans ('Delmar') and a susceptible variety ('Lee') infected with *Meloidogyne incognita acrita* was made. Enzyme activity was low at feeding sites in the resistant variety and host response to the nematode is characterized by necrosis. In the susceptible variety, enzyme activity is greatly increased at feeding sites, syncytia develop, and the nematode completes its life cycle.

38. ______ and J. A. Veech. 1969. THE HISTOCHEMICAL LOCALIZATION OF OXIDOREDUCTIVE ENZYMES OF SOYBEANS INFECTED WITH THE ROOT-KNOT NEMATODE "MELOIDOGYNE INCOGNITA ACRITA". Phytopathology 59(4): 418-425.

Soybean roots infected with *M. incognita acrita* were induced to form the following enzymes by the 2d-stage larvae at the nematode feeding sites: malate, isocitrate, succinate, glucose-6-phosphate, 6-phosphogluconate dehydrogenases and NAD and NADP diaphorases.

39. ______ and J. A. Veech. 1970. MORPHOLOGY AND HISTOCHEMISTRY OF SOYBEAN ROOTS INFECTED WITH "HETERODERA GLYCINES". Phytopathology 60(10): 1493-1498.

Observations of soybean roots of a susceptible host 'Lee' and a resistant host, 'Pickett' showed increased enzyme levels as the syncytia developed, whereas in the resistant host, enzyme activity increased until the syncytia became necrotic and deteriorated.

40. Epps, J. M. 1969. NINE VARIETIES OF SOUTHERN PEAS RESISTANT TO THE SOYBEAN CYST NEMATODE. Plant Dis. Rptr. 53(4): 245.

Nine varieties of *Vigna sinensis* may be used as rotation crops in soybean cultivation because they are resistant to the Tennessee and Virginia strains of *Heterodera glycines.*

41. ______ 1969. SURVIVAL OF THE SOYBEAN CYST NEMATODE IN SEED STOCKS. Plant Dis. Rptr. 53(5): 403-405.

Soybean seed from Missouri cleaning plants was contaminated with soil peds containing viable cysts of *Heterodera glycines.* This was determined by finding infected soybean plants 5 months after planting contaminated seed.

42. ______ 1969. SURVIVAL OF THE SOYBEAN CYST NEMATODE IN THE DIGESTIVE SYSTEMS OF BIRDS. (Abstract) J. Nematol. 1(4): 286.

The soybean cyst nematode, *Heterodera glycines*, can survive the digestive process of birds, which probably accounts for a means of spread for this nematode.

43. ______ 1970. BREEDING SOYBEANS FOR RESISTANCE TO THE SOYBEAN CYST NEMATODE, "HETERODERA GLYCINES" AND THE ROOT-KNOT NEMATODE, "MELOIDOGYNE" SPP. 10th Internatl. Nematol. Symp., Eur. Soc. Nematologists, Pescara, Italy, Sept. 8-13: 109-110.

Breeding soybeans for resistance to *H. glycines* shows Peking variety as the major source of resistance in the development of the resistant varieties Pickett, Dyer, and Custer. Varieties Jackson, Hill, Delmar, Palmetto, S-100, Laredo, and others are resistant to root-knot nematodes. Varieties showing resistance to more than one species of nematodes are Dyer, which is resistant to two species of root-knot nematodes and both Dyer and Pickett, which are resistant to the soybean cyst nematode and the reniform nematode, *Rotylenchulus reniformis.*

44. ______ 1970. FIELD AND GREENHOUSE EVALUATIONS OF NEMATICIDES FOR SOYBEAN CYST NEMATODE CONTROL. (Abstract) Phytopathology 60(4): 583.

Systemic and contact nematicides used in greenhouse tests showed reduction in the number of *Heterodera glycines* on soybeans. In field tests, increased vigor in plants was observed with some increase in yield. No nematicide treatment increased yields over that of resistant varieties.

45. ______ 1971. RECOVERY OF SOYBEAN CYST NEMATODES ("HETERODERA GLYCINES") FROM THE DIGESTIVE TRACTS OF BLACKBIRDS. J. Nematol. 3(4): 417-419.

Cysts of the soybean cyst nematode were recovered from the digestive tracts of blackbirds and remained viable. A suggestion is made that migratory birds can spread this nematode from one state to another.

46. ______ 1972. RECOVERY OF SOYBEAN CYST NEMATODES FROM THE DIGESTIVE TRACT OF BLACKBIRDS. Tenn. Farm and Home Sci., Prog. Rpt. 81: 2-3.

Soybean cyst nematodes can pass through the digestive system of three kinds of blackbirds and still remain viable.

47. ______ and L. A. Duclos. 1970. RACES OF THE SOYBEAN CYST NEMATODE IN MISSOURI AND TENNESSEE. Plant Dis. Rptr. 54(4): 319-320.

Populations of *Heterodera glycines* from Arkansas, Missouri, and Tennessee develop on the resistant varieties Pickett, Dyer, Custer, Peking, and P.I. 90763. No morphological differences could be detected and differentiation of races must be made on their ability to develop on resistant varieties.

48. ______ D. I. Edwards, J. M. Good, and R. V. Rebois. 1973. ANNOTATED BIBLIOGRAPHY OF NEMATODES OF SOYBEANS, 1882-1968. Agr. Res. Ser., U.S. Dept. Agr. ARS-S-8. 75 pp.

A listing of 380 references on nematodes of soybean is given.

49. ______ and E. E. Hartwig. 1972. REACTION OF SOYBEAN VARIETIES AND STRAINS TO RACE 4 OF THE SOYBEAN CYST NEMATODE. (Abstract) J. Nematol. 4(4): 222.

Of the 3,000 soybean varieties and strains tested, only a few showed varying degrees of resistance to Race 4 of *Heterodera glycines*. Those selected for use in breeding programs included P.I. 88,788, P.I. 89,772, and P.I. 87,631-1. P.I. 88,788 is superior because of low lodging and shattering characteristics; and it is resistant to *Meloidogyne incognita acrita*.

50. ______ and E. E. Hartwig. 1973. FORREST, A NEW NEMATODE-RESISTANT SOYBEAN VARIETY. Univ. of Tenn., Bul. 513. 11 pp.

A new soybean variety, Forrest, was released by the Mississippi and Tennessee Agricultural Experiment Stations and Agricultural Research Service, USDA. The variety has resistance to *Heterodera glycines* (Race 3), *Meloidogyne incognita acrita*, and *Rotylenchulus reniformis*.

51. Feldmesser, J., D. I. Edwards, J. M. Epps, and others. 1971. ESTIMATED CROP LOSSES FROM PLANT-PARASITIC NEMATODES IN THE UNITED STATES. Spec. Pub. No. 1, Soc. of Nematologists. 7 pp.

Using 1967-68 average prices and 1962-68 acreages, nematodes caused soybean losses of an estimated 5 billion pounds, with a farm value of nearly $252 million.

52. Ferris, V. R. and R. L. Bernard. 1971. EFFECT OF SOIL TYPE ON POPULATION DENSITIES OF NEMATODES IN SOYBEAN ROTATION FIELDS. J. Nematol. 3(2): 123-128.

The effect of four soil types rotated to corn, soybeans, wheat, and forage was studied in relation to nematode populations. High densities of *Helicotylenchus pseudorobustus* were found in dark silty clay loams as was *Tylenchorhynchus acutus*. *Paratylenchus projectus* was found in light silt loams rather than in the darker soils. *Xiphinema americanum* was found in all soil types and crop sequences in high densities. *T. martini* was present in all soil types but did not build up. *Pratylenchus* species were low in all rotated blocks and all soil types.

53. ______ J. M. Ferris, R. L. Bernard, and A. H. Probst. 1971. COMMUNITY STRUCTURE OF PLANT-PARASITIC NEMATODES RELATED TO SOIL TYPES IN ILLINOIS AND INDIANA SOYBEAN FIELDS. J. Nematol. 3(4): 399-408.

Using a resemblance equation and community ordination, community structure of plant parasitic nematodes was studied and found to vary on dark- and light-colored soils of Illinois and Indiana. *Helicotylenchus pseudorobustus, Pratylenchus* spp., *Paratylenchus projectus, Tylenchorhynchus acutus, T. martini,* and *Xiphinema americanum* are considered.

54. Gilbert, J. C., J. T. Chinn, and J. S. Tanaka. 1970. FOUR NEW TROPICAL VEGETABLE-TYPE SOYBEANS WITH ROOT-KNOT NEMATODE RESISTANCE. Res. Rpt. Hawaii Agr. Exp. Sta., No. 178, 7 pp.

Four new soybean varieties resistant to *Meloidogyne* spp. are described.

55. Gipson, I., K. S. Kim, and R. D. Riggs. 1969. ULTRASTRUCTURE OF EARLY DEVELOPMENT OF SYNCYTIUM BY "HETERODERA GLYCINES" IN ROOTS OF SOYBEANS. (Abstract) Phytopathology 59(8): 1027-1028.

Cell-wall disintegration and eventual nondistinguishable component cells were observed in the development of syncytia in soybean roots infected with *H. glycines*. Changes were observed in the plasma membrane and vacuoles.

56. ______ K. S. Kim, and R. D. Riggs. 1971. AN ULTRASTRUCTURAL STUDY OF SYNCYTIUM DEVELOPMENT IN SOYBEAN ROOTS INFECTED WITH "HETERODERA GLYCINES". Phytopathology 61(4): 347-353.

Electron microscopy studies of soybean roots infected with *H. glycines* showed that perforations in the cell wall are responsible for the formation of syncytia. Changes were observed in vacuole size, plastid numbers, and endoplasmic reticulum-like material.

57. Golden, A. M., J. M. Epps, R. D. Riggs, and others. 1970. terminology and identity of infraspecific forms of the soybean cyst nematode ("heterodera glycines"). Plant Dis. Rptr. 54(7): 544-546.

The term "race" was designated for infraspecific forms of *H. glycines.* Four races of the nematode exist in the United States and can be differentiated on their ability to reproduce on five soybean varieties.

58. Guiran, G. de. 1970. le probleme "meloidogyne" sur tabac a madagascar. Cah. O. R. S. T. O. M., Ser. Biol. No. 11, pp. 187-208. (English summary pp. 187-188.)

Soybean is highly resistant to populations of *M. javanica* and *M. incognita.* Soybean could be used in rotations to reduce nematode populations but should be checked periodically for possible buildup of aggressive biotypes of the nematodes.

59. Hadden, C. H., J. M. Epps, and C. J. Southards. 1972. soybean nematode control. Agr. Ext. Serv., Univ. of Tenn. Pub. 637, 8 pp.

Several kinds of nematodes are associated with soybeans in Tennessee and cause an estimated loss of 10 percent. The soybean cyst nematode and root-knot nematodes occur in most areas where soybeans are grown. Five resistant varieties have been developed for Race 3 of the soybean cyst nematode but no commercial variety is available with resistance to Race 4. Pickett-71 will probably replace Pickett.

60. Hagge, A. H. 1969. soybean-cyst-nematode damage as associated with the intensive culture of soybeans in southeastern missouri. Spec. Rpt. Iowa State Univ. Sci. Technol. No. 64, pp. 41-48.

Loss of crops in the Mississippi River Valley caused by *Heterodera glycines* is associated with successive planting of soybeans and limited crop rotation. To retard the spread of the nematode, State-Federal quarantines have been established. Also resistant varieties have been developed.

61. Hamblen, M. L., D. A. Slack, and R. D. Riggs. 1972. temperature effects on penetration and reproduction of soybean-cyst nematode. (Abstract) Phytopathology 62(7): 762.

Penetration and reproduction of the soybean cyst nematode on Lee soybeans was optimum at 28° C. Optimum for *Lupinus albus* and *Vigna wilmsii* was 22° C.

62. Hartwig, E. E. and J. M. Epps. 1970. an additional gene for resistance to the soybean cyst nematode, "heterodera glycines". (Abstract) Phytopathology 60(4): 584.

Complete resistance to a strain of the soybean cyst nematode found in Virginia was shown in P.I. 90763. An additional recessive gene for resistance was determined for this line.

63. ______ and J. M. Epps. 1972. breeding soybeans with resistance to nematodes. Soybean News 23(2): 2, 6.

The problems involved in breeding soybeans with resistance to the root-knot and soybean cyst nematodes are discussed.

64. Hickey, K. D. 1971. fungicide and nematicide tests. results of 1970. Amer. Phytopath. Soc. 26: 167-168.

These reports include two from Virginia and one from Florida on nematicides for control of nematodes associated with soybeans. Nematodes mentioned are *Meloidogyne incognita, Tylenchorhynchus* spp., *Criconemoides* spp., *Belonolaimus* spp., *Pratylenchus* spp., and *Tylenchus* spp.

65. Ibrahim, I. K. A., I. A. Ibrahim, and S. I. Massoud. 1972. induction of galling and lateral roots on five varieties of soybeans by "meloidogyne javanica" and "m. incognita". Plant Dis. Rptr. 56(10): 882-884.

Using galls as an index for susceptibility, the soybean variety Lee showed the highest degree of susceptibility to *M. javanica,* followed by Hampton, N. C. Hampton, Laredo, and Delmar. Laredo and Delmar showed resistance to *M. incognita* but the other varieties were susceptible. More lateral roots were observed on Lee infected by either nematode than on healthy plants. Hampton showed reduction of lateral roots by infection of either nematode but Laredo and Delmar roots were not affected.

66. Inagaki, H. and M. Tsutsumi. 1971. survival of the soybean cyst nematode, "heterodera glycines" ichinohe (tylenchida: heteroderidae) under certain storing conditions. Appl. Ent. Zool. 6(4): 156-162.

Viability of encysted eggs and larvae of *H. glycines* stored in air-dried and naturally wet soil for 11 years was studied. Encysted eggs were viable after 9 years in air-dried soil and 8 years in wet soil. Emerged second stage larvae from both wet and dry soil infected soybean roots till the 7th year of storage.

67. Kinloch, R. A. 1972. EVALUATION OF VARIETAL AND NEMATICIDAL COMBINATION FOR THE CONTROL OF "MELOIDOGYNE INCOGNITA" ON SOYBEAN. (Abstract) J. Nematol. 4(4): 228-229.

Two studies on the control of *M. incognita* on soybeans showed that treatment of two susceptible varieties 'Hood' and 'Hampton 266A' with nematicides produced the greatest yield increases; however, treatment of a more resistant variety 'Bragg' produced the greatest soybean production. To maximize yields on infested soil, proper soybean varietal selection in combination with nematicidal treatment is necessary.

68. ______ and K. Hinson. 1973. THE FLORIDA PROGRAM FOR EVALUATING SOYBEAN ("GLYCINE MAX" L. MERR.) GENOTYPES FOR SUSCEPTIBILITY TO ROOT-KNOT NEMATODE DISEASE. Soil and Crop Sci. Soc. Fla. Proc. 32: 173-176.

Soybean lines are evaluated for their susceptibility to *Meloidogyne incognita* and *M. javanica* by the amount of root galling produced (0=none, 4=75-100 percent of root galled). Numerous soybean lines were screened using this method and degrees of susceptibility have been defined. A program for developing soybean varieties resistant to *Meloidogyne* spp. and the soybean cyst nematode (*Heterodera glycines*) is in progress.

69. ______ and J. H. Walker. 1971. ROOT-KNOT DISEASES IN FLORIDA SOYBEANS. Sunshine State Agr. Res. Rpt. 16(3): 12-14.

The use of resistant varieties along with nematicides is suggested as a means of controlling *Meloidogyne incognita* on soybeans.

70. Koliopanos, C. N. and A. C. Triantaphyllou. 1971. HOST SPECIFICITY AND MORPHOMETRICS OF FOUR POPULATIONS OF "HETERODERA GLYCINES" (NEMATODA: HETERODERIADE). J. Nematol. 3(4): 364-368.

Four populations of the soybean cyst nematode from Virginia, North Carolina, Arkansas, and Tennessee differed in their ability to reproduce on five resistant soybean cultivars, mungbean, and lespedeza. Differences also occurred in the body, tail, and tail terminus lengths of second-stage larvae.

71. ______ and A. C. Triantaphyllou. 1972. EFFECT OF INFECTION DENSITY ON SEX RATIO OF "HETERODERA GLYCINES". Nematologica 18(1): 131-137.

Low infection densities afforded equal numbers of males and females whereas high infection densities increased the male to female ratio in the roots of soybean seedlings.

72. Lehman, P. S. 1969. HATCHING RESPONSES OF "HETERODERA GLYCINES" TO HYDROGEN ION CONCENTRATIONS AND INORGANIC IONS. (Abstract) J. Nematol. 1(1): 14-15.

Maximal hatching of yellow cysts occurred at pH 3.5 and was depressed at pH 5.5. Cations Mg^{++}, NH_4^{++} inhibited hatching when compared to Ca^{++}. Of the anions, NO_3^- inhibited hatching more than Cl^- and SO_4^{--}. NH_4NO_3 inhibited hatching, whereas $CaSO_4$ stimulated hatching. Interactions of inorganic ions and H^+ showed that the prime influence of H^+ occurred at pH 3.2 and 4.0; and the influence of H^+ was secondary to the influence of inorganic ions at pH 4.8, 5.6, and 6.4.

73. ______ K. R. Barker, and D. Huisingh. 1970. THE EFFECT OF RACES OF "HETERODERA GLYCINES" ON NODULATION AND NITROGEN FIXATION IN SOYBEAN. (Abstract) Phytopathology 60(9): 1299-1300.

Soybean plants infected with Race 1 of the soybean cyst nematode from Wilmington, N.C., showed severe nitrogen deficiency, whereas plants infected with Races 2 and 4 did not show these symptoms. Race 1 reduced nodulation, while Races 2 and 4 caused no significant reduction except at higher inoculum levels.

74. ______ K. R. Barker, and D. Huisingh. 1971. EFFECTS OF PH AND INORGANIC IONS ON EMERGENCE OF "HETERODERA GLYCINES". Nematologica 17(3): 467-473.

Emergence of *H. glycines* was greatest at pH 3.5 and inhibited at pH 5.5. Inhibition was seen in compounds containing NH^+ and NO_3^- whereas $CaSO_4$ stimulated emergence.

75. ______ D. Huisingh, and K. R. Barker. 1971. THE INFLUENCE OF RACES OF "HETERODERA GLYCINES" ON NODULATION AND NITROGEN-FIXING CAPACITY OF SOYBEAN. Phytopathology 61(10): 1239-1244.

A significant decrease in nodulation and the nitrogen fixing capacity of Lee soybeans was seen when inoculated with Race 1 of *H. glycines* and *Rhizobium japonicum*. Races 2 and 4 did not show this decrease. Severe chlorosis of soybean was seen on those plants infected with Race 1, whereas Races 2 and 4 showed none.

76. Lindsey, D. W. and E. J. Cairns. 1971. PATHOGENICITY OF THE LESION NEMATODE, "PRATYLENCHUS BRACHYURUS", ON SIX SOYBEAN CULTIVARS. J. Nematol. 3(3): 220-226.

P. brachyurus can cause reduction in soybean yields as seen in the 'Hood' variety. Other varieties, 'Custer', 'Bragg', 'Dyer', 'Pickett', and 'Hill' (known to be resistant to other soybean nematode pathogens) showed tolerance to *P. brachyurus*.

77. Luedders, V. D., L. F. Williams, and S. Matson. 1968. REGISTRATION OF CUSTER SOYBEANS. Crop Sci. 8: 402.

Custer soybean was developed by incorporating cyst nematode and Phytophthora rot resistance into the variety Scott.

78. Malek, R. B. and D. I. Edwards. 1973. BATTLING THE SOYBEAN CYST NEMATODE. Ill. Res. 15: 12-13.

A general discussion of the soybean cyst nematode, *Heterodera glycines*, is given with control suggestions. Blends of susceptible and resistant soybean seed is offered as a control possibility.

79. ______ D. P. Taylor, and D. I. Edwards. 1970. THE BARLEY ROOT-KNOT NEMATODE. Ill. Res. 12(2): 3-4.

Although *Meloidogyne naasi* has not been found attacking field soybeans in Illinois, greenhouse studies have shown soybeans as a host.

80. Michell, R. E. and D. I. Edwards. 1973. SUSCEPTIBILITY OF SOYBEAN TO "MELOIDOGYNE NAASI". Plant Dis. Rptr. 57(3): 207-209.

An isolate of the barley root-knot nematode, *M. naasi*, parasitized soybeans but was not pathogenic at the highest inoculum level of 8,000 larvae. Nine of ten soybean varieties screened for susceptibility to *M. naasi* proved to be susceptible.

81. Miller, L. I. 1968. PATHOGENICITY AND DEVELOPMENT OF THE TENN. 1 ISOLATE OF "HETERODERA GLYCINES" ON "ANTIRRHINUM MAJUS". (Abstract) Nematologica 14(1): 10.

Eleven isolates of *H. glycines* were tested for their ability to develop egg-bearing cysts on 'Snowflake' snapdragon (*A. majus*). Isolates Va. 1, Ark. 1, Miss. 1, and Ky. 1 formed few cysts while Tenn. 1 formed numerous cysts. The Tenn. 1 isolate developed an average of 56 cysts per plant on snapdragon and 74 on 'Lee' soybean. Foliar and root growth of snapdragon was reduced 19 and 49 percent, respectively. Cyst and larvae length and length and breadth of eggs of the Tenn. 1 isolate on soybean were greater than those found on snapdragon.

82. ______ 1969. CORRELATION OF PAIRS OF MORPHOMETRIC CHARACTERS OF ELEVEN ISOLATES OF "HETERODERA GLYCINES". (Abstract) J. Nematol. 1(4): 297-298.

Morphometric comparisons for isolates of *H. glycines* demonstrated few differences therefore limiting the use of this system to this species.

83. ______ 1969. PHYSIOLOGIC VARIATION OF FIVE ISOLATES OF THE SOYBEAN CYST NEMATODE. (Abstract) Va. J. Sci. 20: 99.

Five isolates of *Heterodera glycines* were differentiated by their abilities to reproduce on the following plants: *Vicia villosa* 'Madison', *Phaseolus aureus* 'Kiloga', *P. vulgaris* 'Bountiful', and *Glycine ussuriensis*.

84. ______ 1969. PHYSIOLOGIC VARIATION OF SIX ISOLATES OF "HETERODERA GLYCINES". (Abstract) Phytopathology 59(11): 1558.

Six isolates of *H. glycines* were differentiated by their ability to reproduce on the following six plants: *Glycine max* 'Lee', *G. gracilis, Cassia tora, Trifolium hybridum* 'F.C. 34088', *Vicia sativa* 'Warrior', and *Penstemon grandiflorus*.

85. ______ 1970. DIFFERENTIATION OF ELEVEN ISOLATES AS RACES OF THE SOYBEAN CYST NEMATODE. (Abstract) Phytopathology 60(6): 1016.

Eleven isolates of *Heterodera glycines* were differentiated by their ability to reproduce on the following varieties of *Glycine max*: Peking, Pine Dell, P.I. 90763, P.I. 88788, P.I. 87631-1, P.I. 79693, P.I. 91684, and P.I. 84611.

86. ______ 1970. INTRASPECIFIC VARIATION IN "HETERODERA GLYCINES". (Abstract) 10th Internatl. Nematol. Symp., Eur. Soc. Nematol., Pescara, Italy, Sept. 8-13: 10-11.

Differences in 22 morphological characters of eleven isolates of *H. glycines* could not be used to distinguish the isolates as subspecies. Each of the isolates was differentiated as a distinct race by its ability to reproduce on eight lines of *Glycine max*. The isolates were reproductively compatible.

87. ______ 1971. PHYSIOLOGIC VARIATION WITHIN THE VIRGINIA-2 POPULATION OF "HETERODERA GLYCINES". (Abstract) J. Nematol. 3(4): 318.

Single cyst cultures of *H. glycines* from 7 areas within a field of Va. 2 population were compared to a composite culture designated as Race 2. Five races were distinguished. Four different groups were differentiated by the number of females on 'Lee' soybean. Miller recommends that Lee not be included because levels of reproduction varied greatly between isolates.

88. ______ and P. L. Duke. 1966. DEVELOPMENT OF THE VIRGINIA-2 POPULATION OF "HETERODERA GLYCINES" ON SOYBEANS. (Abstract) Va. J. Sci. 17(4): 245-246.

Using the Ross-Brim double-row method and Lee soybean as a susceptible check, the susceptibility of 1904 soybean lines and varieties were checked against the Va. 2 population of *H. glycines*. No females were found on P.I. 90763 and few females were found on the following plant introductions:

63468, 81042-1, 84611, 85903, 87631-1, 88788, 88287, 89772, 92686, 206258, 248511, 209331, and the varieties Pine Dell and Old Dominion.

89. ______ and P. L. Duke. 1967. DEVELOPMENT OF ELEVEN ISOLATES OF THE SOYBEAN CYST NEMATODE ON FOUR SPECIES OF THE SCROPHULARIACEAE. (Abstract) Va. J. Sci. 18(4): 143.

Eleven isolates of *Heterodera glycines* were tested for their ability to develop egg-bearing females on four *Penstemon* species. None developed on *P. barbatus*. Only the Va. 1 isolate produced numerous females on *P. angustifolius*. On *P. ovatus* a few females were produced by the Va. 1, N.C. 1, Mo. 1, Tenn. 1, Ill. 1, Miss. 1, and Ky. 1; and a medium number by the Ark. 1 isolate. All isolates produced numerous females on *P. wilcoxi*, except Va. 2 and N.C. 1, which developed a few females; and Va. 4 and Miss. 1 isolate, which produced a medium number of females. Lee soybean was used as a check.

90. ______ and B. J. Gray. 1966. REACTION OF LAMBSQUARTER, SWISS CHARD, AND SPINACH TO ELEVEN ISOLATES OF THE SOYBEAN CYST NEMATODE. (Abstract) Va. J. Sci. 17(4): 246.

Eleven isolates of *Heterodera glycines* were tested to determine their ability to develop egg-bearing females on lambsquarter, Swiss chard, and spinach. Lee soybean was used as a check. None of the isolates produced females on lambsquarter or Swiss chard. Va. 3 and Mo. 1 isolates formed 2 to 6 females per plant on spinach.

91. Miller, W. O., P. A. Thomas, and M. G. Morris. 1971. NEMATODE DISEASES OF SOYBEANS AND THE ECONOMICS OF THEIR CONTROL WITH FUMAZONE NEMATICIDE. Down to Earth 26(4): 25-27.

Fumazone 86 was shown to be a practical and economical method of controlling nematode problems associated with soybeans.

92. Morris, G. and M. C. McDaniel. 1970. NEMATICIDES INCREASE SOYBEAN YIELDS ON SOYBEAN CYST NEMATODE INFESTED LANDS. Down to Earth 25 (4): 4-5.

Three field experiments showed that the use of a nematicide increased the yield of soybeans in areas with high cyst and root-knot nematode populations.

93. Mulvey, R. H. 1972. IDENTIFICATION OF "HETERODERA" CYSTS BY TERMINAL AND CONE TOP STRUCTURES. Canad. J. Zool. 50: 1277-1292.

This is a taxonomic key based on studies of the terminal and cone top structures of *Heterodera* cysts. Examination of young *H. glycine* cysts reveals a second underbridge in several cysts. Figures 79, 80, and 100 supplement the key to *H. glycines*.

94. Norton, D. C. and N. Burns. 1971. COLONIZATION AND SEX RATIOS OF "PRATYLENCHUS ALLENI" IN SOYBEAN ROOTS UNDER TWO SOIL MOISTURE REGIMES. J. Nematol. 3(4): 374-377.

More *P. alleni* per unit length of taproot were observed in the dry regime than in the wet regime. The ratio of males to females was higher in the dry regime.

95. ______ L. R. Frederick, P. E. Ponchillia, and J. W. Nyhan. 1971. CORRELATIONS OF NEMATODES AND SOIL PROPERTIES IN SOYBEAN FIELDS. J. Nematol. 3(2): 154-163.

Total nematode populations from 40 soybean fields were correlated with pH; percentage sand, silt, clay, and organic matter; cation-exchange capacity; saturation percentage; and percentage saturation. Nematode species or groups counted included: Dorylaims (Dorylaimoidea minus *Xiphinema americanum*), Tylenchinae-Psilenchinae Tylenchoidea, *Tylenchorhynchus nudus*, *Helicotylenchus pseudorobustus*, *Hoplolaimus galeatus*, and *X. americanum*.

96. Nyhan, J. W., L. R. Frederick, and D. C. Norton. 1972. ECOLOGY OF NEMATODES IN CLARION-WEBSTER TOPOSEQUENCES ASSOCIATED WITH "GLYCINE MAX" (L.) MERRILL. Soil Sci. Soc. Amer. Proc. 36(1): 74-78.

Toposequence variations in soil and plant properties were defined and related to nematode populations associated with soybeans. Fewer numbers of *Aphelenchus avenae*, *Helicotylenchus pseudorobustus*, *Tylenchorhynchus nudus*, *Tylenchus* spp., and nonstylet nematodes occurred at the toeslope position in the toposequences. Nematode populations were more closely correlated with plant variables than with soil variables at each toposequence.

97. Orbin, D. P. 1973. HISTOPATHOLOGY OF SOYBEAN ROOTS INFECTED WITH "HELICOTYLENCHUS DIHYSTERA". J. Nematol. 5(1): 37-40.

Observations of soybean roots infected with *H. dihystera* showed adults and larvae in semi-endoparasitic and endoparasitic feeding positions; eggs were found within the cortex of the roots. Small, brown lesions were observed around the heads of the nematodes. Endoparasitic nematodes were found in the root cortex, usually coiled within the walls of one or two cells. The nematode moved through the cell wall and the cytoplasm appeared normal.

98. ______ and E. J. Cairns. 1971. HISTOPATHOLOGY OF SOYBEAN ROOTS INFECTED WITH "HELICOTYLENCHUS DIHYSTERA" (COBB) SHER. (Abstract) J. Nematol. 3(4): 322-323.

The histopathology of soybean roots infected with *H. dihystera* was studied. In the vicinity of the nematode head, small, brown lesions were observed.

99. Park, J. S. and S. C. Han. 1968. STUDIES ON RESISTANT VARIETIES TO THE SOYBEAN CYST NEMATODE, "HETERODERA GLYCINES" ICHINOHE. Res. Rpt. Off. Rural Develop., Korea. 11(3): 67-73. (In Korean with English summary, p. 292.)

Of 41 soybean varieties tested for resistance to *H. glycines* in Korea, the following are resistant: PI-90763, PI-84751, Medium-green, Haman, Jaerae, Buseok, L9-673, and Changan-baekmok.

100. ______ S. C. Han, and Y. P. Ri. 1969. STUDIES ON VARIETAL RESISTANCE OF SOYBEAN TO "HETERODERA GLYCINES" AND ON THE DAMAGE CAUSED BY IT. J. Plant Protect., Suwon, Korea, 7(1): 21-25.

(Article not annotated because it was unavailable).

101. Perry, V. G., G. C. Smart, Jr., and R. S. Mullin. 1967. THE SOYBEAN CYST NEMATODE, "HETERODERA GLYCINES", FOUND IN FLORIDA. Plant Dis. Rptr. 51(12): 1066.

The soybean cyst nematode *H. glycines* has been reported for the first time in Escambia County, Fla.

102. Phillips, D. V. and K. R. Barker. 1969. RESPONSES IN GROWTH AND YIELD OF SOYBEANS TO SEVERAL POPULATION LEVELS AND COMBINATIONS OF CERTAIN NEMATODES. (Abstract) J. Nematol. 1(1): 23.

The nematicides Nemagon, Furadan, and Temik were tested against *Pratylenchus brachyurus*, *P. zeae*, *Tylenchorhynchus claytoni*, *Meloidogyne incognita*, *Belonolaimus longicaudatus*, *Helicotylenchus dihystera*, *Trichodorus christiei*, and *Heterodera glycines*. In five tests, 3 to 78 percent less yield occurred in untreated plots, with the greatest yield reduction occurring where populations of *H. glycines* were high. Yield data indicated that *Pratylenchus* spp., *B. longicaudatus*, and *T. claytoni* are contributing to yield reductions on soybeans in North Carolina.

103. Rebois, R. V. 1970. EFFECT OF SOIL TEMPERATURE AND MOISTURE ON INFECTIVITY AND DEVELOPMENT OF "ROTYLENCHULUS RENIFORMIS" ON SOYBEANS, "GLYCINE MAX" L. MERR. (Abstract) J. Parasitol. 56(4): 278.

A soil temperature of 29.5° C was optimum for infectivity and number of mature females of *R. reniformis* produced. Soil held at 8.1 percent moisture at 29.5° showed more females parasitizing roots than any other moisture regime.

104. ______ 1971. THE EFFECT OF "ROTYLENCHULUS RENIFORMIS" INOCULUM LEVELS ON YIELD, NITROGEN, POTASSIUM, PHOSPHORUS, AND AMINO ACIDS OF SEED OF RESISTANT AND SUSCEPTIBLE SOYBEAN ("GLYCINE MAX"). (Abstract) J. Nematol. 3(4): 326-327.

R. reniformis on soybeans caused a reduction in dry seed yield and phosphorus content of seeds. The percentage of leucine in seeds from resistant plants was less than the average decrease for all cultivars.

105. ______ 1973. EFFECT OF SOIL TEMPERATURE ON INFECTIVITY AND DEVELOPMENT OF "ROTYLENCHULUS RENIFORMIS" ON RESISTANT AND SUSCEPTIBLE SOYBEANS, "GLYCINE MAX". J. Nematol. 5(1): 10-13.

In studies on the effect of soil temperature on infectivity and development of *R. reniformis* on resistant and susceptible soybean varieties, *R. reniformis* developed best at 25 and 29.5° C. The female life cycle is best completed at 29.5° and plant growth is best at 21.5°. No egg masses were present on roots grown at 15 and 36°.

106. ______ 1973. EFFECT OF SOIL WATER ON INFECTIVITY AND DEVELOPMENT OF "ROTYLENCHULUS RENIFORMIS" ON SOYBEAN, "GLYCINE MAX". J. Nematol. 5(4): 246-249.

The infectivity of *R. reniformis* on 'Lee' soybeans was greatest when the soil water content was between 7.2 and 13.0 percent. Reduction of root invasion by the nematode occurred at wetter (15.5 to 19.0 percent) and dryer (3.4 to 5.8 percent) soil regimes.

107. ______ J. M. Epps, and E. E. Hartwig. 1970. CORRELATION OF RESISTANCE IN SOYBEANS TO "HETERODERA GLYCINES" AND "ROTYLENCHULUS RENIFORMIS". Phytopathology 60(4): 695-700.

Soybean cultivars (Dyer, Custer, Pickett, Peking, D66-12392, D66-12394, and 2 F_4's of Hill × P.I. 90763) resistant to *H. glycines*, are resistant to *R. reniformis*. There was no relationship established between *R. reniformis* and *Meloidogyne incognita* resistance in soybeans.

108. ______ and W. C. Johnson. 1973. EFFECT OF "ROTYLENCHULUS RENIFORMIS" ON YIELD AND NITROGEN, POTASSIUM, PHOSPHORUS, AND AMINO ACID CONTENT OF SEED OF "GLYCINE MAX". J. Nematol. 5(1): 1-6.

At an inoculum level of 10,000 *R. reniformis* per 3.8 liters of soil, dry seed yields of Hood decreased and those of Pickett increased. At an inoculum level of 25,000 nematodes, yields of resistant and susceptible soybean varieties were decreased. Phosphorus content decreased and potassium content increased in seeds from plants which received low inoculum levels. There was little change in nitrogen content and leucine content was slightly less in seeds from infected plants.

109. REYNOLDS, G. 1972. TOUGHEST SOYBEAN PEST KEEPS SPREADING. Farm J., June 1972: 22D.

The possibility of further spread of the soybean cyst nematode to Midwest States is discussed. Some preventative measures to slow down movement are presented.

110. ROBBINS, R. T. and K. R. BARKER. 1971. REPRODUCTIVE RESPONSES OF "BELONOLAIMUS LONGICAUDATUS" TO SOIL TYPE AND TEMPERATURE. (Abstract) J. Nematol. 3(4): 328.

A soil type which was 80 percent sand at 30°C showed the greatest reproduction response for *B. longicaudatus*.

111. ROSS, J. P. 1969. EFFECT OF "HETERODERA GLYCINES" ON YIELDS OF NONNODULATING SOYBEANS GROWN AT VARIOUS NITROGEN LEVELS. J. Nematol. 1(1): 40-42.

Yield losses were reduced when plots of nonnodulating soybeans infected with *H. glycines* were treated with nitrogen in the form of $NaNO_3$ and compared with untreated infected plots.

112. SCOTT, H. A. and R. D. RIGGS. 1971. IMMUNOELECTROPHORETIC COMPARISONS OF THREE PLANT-PARASITIC NEMATODES. Phytopathology 61(6): 751-752.

Serological tests showed no differences between two races of *Heterodera glycines* and no relationship between the two races of *H. glycines* and *H. betulae*.

113. SHAVROV, G. N. 1968. NEW SPECIES OF "PARAPHELENCHUS" (MICOLETZKY, 1922) (MICOLETZKY) 1925 (NEMATODA, APHELENCHIDAE). Soobshch. dal'nevost. Fil V. L. Komarova sib. Otd. Akad. Nauk SSR. 26: 135-136. (In Russian)

Females of a new nematode species, *P. octolineatus*, were described from around soybean in Primorsk, U.S.S.R.

114. ______ 1968. NEW SPECIES OF PLANT NEMATODES OF THE SUBFAMILY ACROBELINAE (THORNE) 1937. Soobshch. dal'nevost, Fil V. L. Komarova sib Otd. Akad. Nauk SSSR. 26: 137-140. (In Russian)

Two new species of Acrobelinae were described from around soybean in Primorsk, U.S.S.R. The two new species are *Chiloplacus quinilineatus* and *Acrobeloides rectiprocerus*.

115. ______ 1968. STUDY OF THE PLANT NEMATODE FAUNA OF SOYBEANS IN THE PRIMORSKIY KRAY. Soobshch. dal'nevost. Fil V. L. Komarova sib Otd. Akad. Nauk SSSR. 26: 141-144. (In Russian)

Of 84 nematode species associated with soybeans in Primorsk, U.S.S.R., sixteen had not been formerly recorded. Seven new species were described.

116. SLACK, D. A., R. D. RIGGS, and M. L. HAMBLEN. 1972. THE EFFECT OF TEMPERATURE AND MOISTURE ON THE SURVIVAL OF "HETERODERA GLYCINES" IN THE ABSENCE OF A HOST. J. Nematol. 4(4): 263-266.

Larvae of the soybean cyst nematode survived in water at temperatures 0°, 4°, 8°, and 12° C for 630 days. Between 16° and 36° the survival rate was inversely proportional to temperature. Natural populations of the nematode were also affected by temperature in a similar manner but survived for a longer time period. The survival of *H. glycines* was related to moisture level with flooded conditions being less favorable for survival and a daily watering condition being most favorable.

117. SMART, JR., G. C., O. J. DICKERSON, and R. L. SMITH. 1968. REPRODUCTION OF THE SOYBEAN CYST NEMATODE ON 'PICKETT', 'DYER', and 'HAMPTON' SOYBEANS. Soil Crop Sci. Soc. Fla. Proc. 28: 306-309.

The resistant soybean varieties Pickett and Dyer are highly resistant to a population of *Heterodera glycines* present near Cantonment, Florida, whereas the variety, Hampton, was susceptible. Crop rotation is recommended as a means of reducing the possibility of races capable of attacking resistant varieties.

118. ______ and H. R. THOMAS. 1969. SURVIVAL OF EGGS AND LARVAE IN CYSTS OF THE SOYBEAN CYST NEMATODE, "HETERODERA GLYCINES", INGESTED BY SWINE. Helminthol. Soc. Wash. Proc. 36(1): 139-142.

Sampling showed that 19.4 percent of the soybean cyst nematodes ingested by swine survived but failed to infect the soybean variety 'Lee'.

119. SMITH, H. L. 1971. BARE-ROOT CHEMICAL DIPS FOR THE CONTROL OF SOYBEAN CYST NEMATODES ADHERING TO VEGETABLE AND NURSERY TRANSPLANTS. Plant Dis. Rptr. 55(1): 13-16.

The Virginia strain of the soybean cyst nematode was tested for its tolerance to nematicides. Bay 68138 at 600 and 1,000 ppm, Bay 25141 at 1,000 and 2,000 ppm, and Cynem at 2,484 and 4,857 ppm were effective as bare-root dips for this strain.

120. SPEARS, J. F. 1969. ORGANIZED NEMATODE CONTROL PROGRAMMES IN THE USA, pp. 314-323. *In* J. E. Peachey (editor) Nematodes of Tropical Crops. Tech. Commun. Common. Bur. Helminthol. Farnham Royal, Buckinghamshire, England.

This article discusses integrated control measures in combating nematode diseases of plants. *Heterodera glycines* on soybeans is used as an example.

121. SUGIYAMA, S., and others. 1968. STUDIES ON THE RESISTANCE OF SOYA-BEAN VARIETIES TO "HETERODERA GLYCINES". II. DIFFERENCE OF PHYSIOLOGICAL STRAINS FROM KARIWANO AND KIKYOGAHARA. Jap. J. Breed. 18(4): 206-212. (In Japanese with English summary, p. 212.)

A population of *H. glycines* from Kikyogahara, Japan, was more pathogenic on soybean than a population from Kariwano, Japan. The authors concluded that two different strains of the nematode were involved.

122. ______ and K. HIROMA. 1966. A RESISTANT GENE OF SOYBEANS TO THE SOYBEAN CYST NEMATODE OBSERVED FROM THE CROSS BETWEEN PEKING AND JAPANESE VARIETIES. Jap. J. Breed. 16(2): 83-86.

Crosses between the varieties Peking and Nemashirazu and Peking and Shiromeyutaka showed one recessive gene for the former and two for the latter involved with resistance.

123. ______ and K. HIROMA. 1968. STUDIES ON THE RESISTANCE OF SOYBEAN VARIETIES TO "HETERODERA GLYCINES". I. INTERVARIETAL DIFFERENCES IN RESISTANCE. Jap. J. Breed. 18(2): 80-87. (In Japanese with English summary.)

Experiments on the resistance of soybean varieties to *H. glycines* led to the classification of types of resistance in Peking and Gedenshirazu. The Peking types were more resistant to the soybean cyst nematode.

124. TAYLOR, D. P., D. I. EDWARDS, and M. C. SHURTLEFF. 1969. THE SOYBEAN CYST NEMATODE PROBLEM. Coop. Ext. Serv. Rpt. on Plant Dis., Univ. of Ill. 501, 5 pp.

125. ______ R. B. MALEK, and D. I. EDWARDS. 1971. THE BARLEY ROOT-KNOT NEMATODE. IT'S NOT A PROBLEM . . . YET. Crops and Soils 23(6): 14-16.

Meloidogyne naasi reproduced and caused galling on soybean roots but whether this nematode could cause reductions in yield was not determined.

126. TAYLOR, DOUG. 1969. SOYBEAN CYST NEMATODE. The Soybean Farmer, May 1969: 14-15, 22.

Extent of infestations and control measures for 10 states infested with the soybean cyst nematode are summarized.

127. TAYLOR, P. L., J. M. FERRIS, and V. R. FERRIS. 1973. TECHNIQUE FOR QUANTIFYING INJURY TO SEEDLING SOYBEANS BY "PRATYLENCHUS PENETRANS" WITHOUT SACRIFICING THE PLANT. J. Nematol. 5(1): 68-69.

A growth pouch technique is described for screening soybean lines for resistance to *Pratylenchus* spp.

128. TRUSKOVA, G. M. 1972 DESCRIPTION OF A NEW SPECIES OF "ANAPLECTUS" (NEMATODA, PLECTIDAE), WITH A KEY TO SPECIES OF THE GENUS. Zool. Zh. 51(4): 594-596. (In Russian)

A. intermedius n. sp. was found in the roots and rhizophere of soybean in the Amur region of the U.S.S.R.

129. VEECH, J. A. and B. Y. ENDO. 1969. ALTERATIONS IN ENZYME LOCALIZATION IN SOYBEANS INFECTED WITH "MELOIDOGYNE INCOGNITA ACRITA". (Abstract) J. Nematol. 1(4): 307-308.

A correlation between increased enzyme activity and the induction and development of syncytia was demonstrated.

130. ______ and B. Y. ENDO. 1969. THE HISTOCHEMICAL LOCALIZATION OF SEVERAL ENZYMES OF SOYBEANS INFECTED WITH THE ROOT-KNOT NEMATODE "MELOIDOGYNE INCOGNITA ACRITA". J. Nematol. 1(3): 265-276.

Three phosphatases—esterase, peroxidase, and cytochrome oxidase—were more active around the sites of infection of *M. incognita acrita* on soybeans.

131. ______ and B. Y. ENDO. 1970. COMPARATIVE MORPHOLOGY AND ENZYME HISTOCHEMISTRY IN ROOT-KNOT RESISTANT AND SUSCEPTIBLE SOYBEANS. Phytopathology 60(5): 896-902.

Inoculation of susceptible 'Lee' and resistant 'Delmar' soybean plants with *Meloidogyne incognita acrita* initially showed galling response and increased enzyme activity at the feeding sites in both. However, with further disease development in the susceptible host, syncytial development was more extensive with increased levels of enzyme activity occurring. In the resistant host, cell necrosis was commonly seen with little or no increase in enzyme activity.

132. WHITFIELD, N. T., P. L. DUKE, and L. I. MILLER. 1965. VARIATION IN DEVELOPMENT OF ELEVEN ISOLATES OF THE SOYBEAN CYST NEMATODE, "HETERODERA GLYCINES", ON SEVEN LEGUMES. (Abstract) Va. J. Sci. 16(4): 314.

Eleven isolates of *H. glycines* (four from Virginia and one from each of seven other states) varied in their ability to develop egg-bearing females on Korean lespedeza, adzuki bean, yellow sweet clover, button clover, black medic, and Ladino white clover. The Ill. 1 isolate developed females on more of the legumes than any other isolate, whereas Ky. 1 developed the least.

133. ZEHR, E. I. 1972. FUNGICIDE AND NEMATICIDE TESTS. RESULTS OF 1971. Amer. Phytopathol. Soc. 27: 172.

Nine nematicides were tested against *Pratylenchus hexincisus* in a soybean field near Manhattan, Kan. No striking increase in yield was demonstrated and treatments other than fumigants were relatively ineffective against *P. hexincisus* until about 60 days after application. Approximately 35 days later, their effect had diminished.

134. ______ 1973. FUNGICIDE AND NEMATICIDE TESTS. RESULTS OF 1972. Amer. Phytopathol. Soc. 28: 176-177.

Five nematicides were tested for *Hoplolaimus columbus* control on soybeans in Georgia and two for *H. columbus* and *Belonolaimus* spp. control in South Carolina. With the exception of one nematicide, all increased yields significantly. The use of subsoiling is considered in the South Carolina tests.

Genera and Species Appendix by Numerical Reference

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